



SPW32N50C3

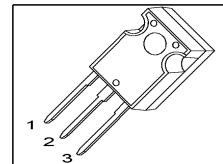
## Cool MOS™ Power Transistor

### Feature

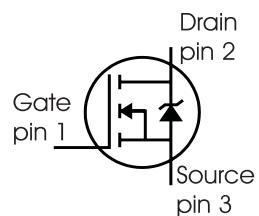
- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme dv/dt rated
- Ultra low effective capacitances
- Improved transconductance

$V_{DS} @ T_{jmax}$	560	V
$R_{DS(on)}$	0.11	$\Omega$
$I_D$	32	A

P-TO247



Type	Package	Ordering Code	Marking
SPW32N50C3	P-TO247	Q67040-S4613	32N50C3



### Maximum Ratings

Parameter	Symbol	Value	Unit
Continuous drain current $T_C = 25^\circ\text{C}$	$I_D$	32	A
$T_C = 100^\circ\text{C}$		20	
Pulsed drain current, $t_p$ limited by $T_{jmax}$	$I_{D\text{ puls}}$	96	
Avalanche energy, single pulse $I_D = 10\text{ A}, V_{DD} = 50\text{ V}$	$E_{AS}$	1100	mJ
Avalanche energy, repetitive $t_{AR}$ limited by $T_{jmax}$ $I_D = 20\text{ A}, V_{DD} = 50\text{ V}$	$E_{AR}$	1	
Avalanche current, repetitive $t_{AR}$ limited by $T_{jmax}$	$I_{AR}$	20	A
Gate source voltage	$V_{GS}$	$\pm 20$	V
Gate source voltage AC ( $f > 1\text{Hz}$ )	$V_{GS}$	$\pm 30$	
Power dissipation, $T_C = 25^\circ\text{C}$	$P_{tot}$	284	W
Operating and storage temperature	$T_j, T_{stg}$	-55... +150	°C

**Maximum Ratings**

Parameter	Symbol	Value	Unit
Drain Source voltage slope $V_{DS} = 400 \text{ V}$ , $I_D = 32 \text{ A}$ , $T_j = 125 \text{ }^\circ\text{C}$	$dv/dt$	50	V/ns

**Thermal Characteristics**

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Thermal resistance, junction - case	$R_{thJC}$	-	-	0.44	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$	-	-	62	
Soldering temperature, 1.6 mm (0.063 in.) from case for 10s	$T_{sold}$	-	-	260	$^\circ\text{C}$

**Electrical Characteristics**, at  $T_j=25^\circ\text{C}$  unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{V}$ , $I_D=0.25\text{mA}$	500	-	-	V
Drain-Source avalanche breakdown voltage	$V_{(BR)DS}$	$V_{GS}=0\text{V}$ , $I_D=20\text{A}$	-	600	-	
Gate threshold voltage	$V_{GS(th)}$	$I_D=1800\mu\text{A}$ , $V_{GS}=V_{DS}$	2.1	3	3.9	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=500\text{V}$ , $V_{GS}=0\text{V}$ , $T_j=25^\circ\text{C}$ , $T_j=150^\circ\text{C}$	-	0.5	25	$\mu\text{A}$
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{V}$ , $V_{DS}=0\text{V}$	-	-	100	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{V}$ , $I_D=20\text{A}$ , $T_j=25^\circ\text{C}$ , $T_j=150^\circ\text{C}$	-	0.09	0.11	
Gate input resistance	$R_G$	f=1MHz, open Drain	-	0.8	-	

**Electrical Characteristics** , at  $T_j = 25^\circ\text{C}$ , unless otherwise specified

<b>Parameter</b>	<b>Symbol</b>	<b>Conditions</b>	<b>Values</b>			<b>Unit</b>
			<b>min.</b>	<b>typ.</b>	<b>max.</b>	
Transconductance	$g_{fs}$	$V_{DS} \geq 2 * I_D * R_{DS(on)max}$ , $I_D = 20\text{A}$	-	30	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$	-	4200	-	pF
Output capacitance	$C_{oss}$		-	1700	-	
Reverse transfer capacitance	$C_{rss}$		-	90	-	
Effective output capacitance, <sup>2)</sup> energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}$ , $V_{DS} = 0\text{V to } 400\text{V}$	-	181	-	pF
Effective output capacitance, <sup>3)</sup> time related	$C_{o(tr)}$		-	350	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 380\text{V}$ , $V_{GS} = 0/10\text{V}$ , $I_D = 32\text{A}$ , $R_G = 2.7\Omega$	-	20	-	ns
Rise time	$t_r$		-	30	-	
Turn-off delay time	$t_{d(off)}$		-	100	-	
Fall time	$t_f$		-	10	-	

**Gate Charge Characteristics**

Gate to source charge	$Q_{gs}$	$V_{DD} = 380\text{V}$ , $I_D = 32\text{A}$	-	15	-	nC
Gate to drain charge	$Q_{gd}$		-	90	-	
Gate charge total	$Q_g$	$V_{DD} = 380\text{V}$ , $I_D = 32\text{A}$ , $V_{GS} = 0$ to $10\text{V}$	-	170	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 380\text{V}$ , $I_D = 32\text{A}$	-	5	-	V

<sup>1</sup>Repetitive avalanche causes additional power losses that can be calculated as  $P_{AV} = E_{AR} * f$ .

<sup>2</sup> $C_{o(er)}$  is a fixed capacitance that gives the same stored energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .

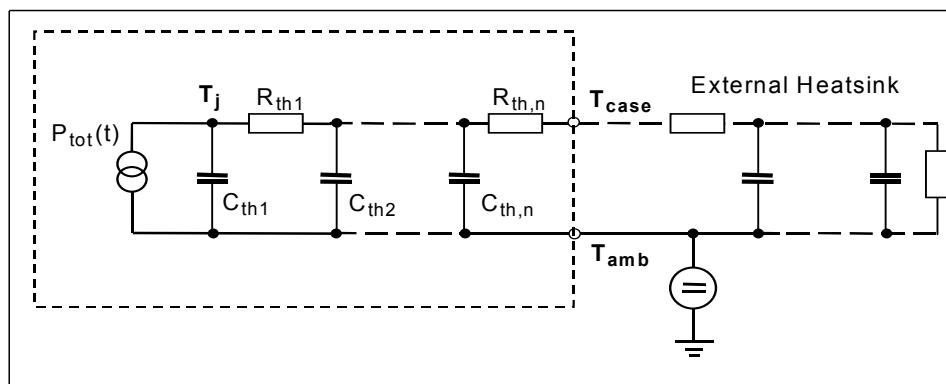
<sup>3</sup> $C_{o(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .

**Electrical Characteristics**, at  $T_j = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Inverse diode continuous forward current	$I_S$	$T_C = 25^\circ\text{C}$	-	-	32	A
Inverse diode direct current, pulsed	$I_{SM}$		-	-	96	
Inverse diode forward voltage	$V_{SD}$	$V_{GS} = 0\text{V}$ , $I_F = I_S$	-	1	1.2	V
Reverse recovery time	$t_{rr}$	$V_R = 380\text{V}$ , $I_F = I_S$ , $dI_F/dt = 100\text{A}/\mu\text{s}$	-	500	-	ns
Reverse recovery charge	$Q_{rr}$		-	15	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	60	-	A
Peak rate of fall of reverse recovery current	$dI_{rr}/dt$		-	1000	-	$\text{A}/\mu\text{s}$

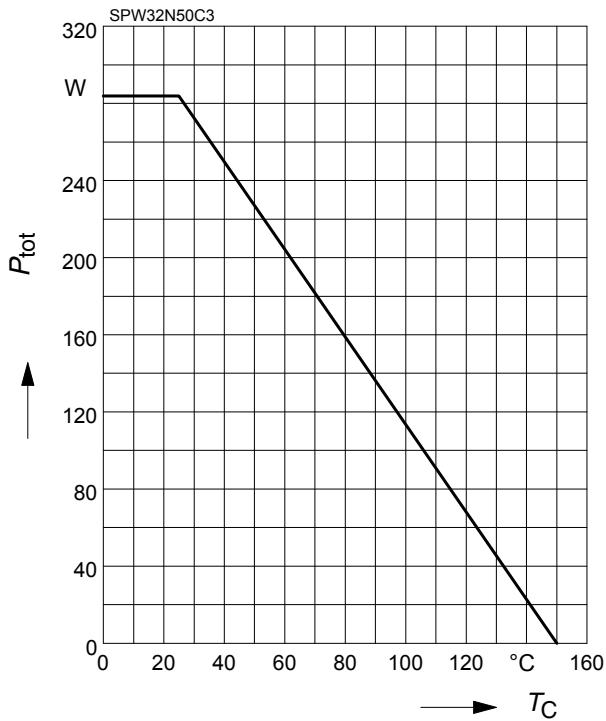
**Typical Transient Thermal Characteristics**

Symbol	Value	Unit	Symbol	Value	Unit
Thermal resistance			Thermal capacitance		
$R_{th1}$	0.004367	K/W	$C_{th1}$	0.0006644	Ws/K
$R_{th2}$	0.008742		$C_{th2}$	0.002479	
$R_{th3}$	0.017		$C_{th3}$	0.00336	
$R_{th4}$	0.081		$C_{th4}$	0.009048	
$R_{th5}$	0.103		$C_{th5}$	0.017	
$R_{th6}$	0.049		$C_{th6}$	0.114	



## 1 Power dissipation

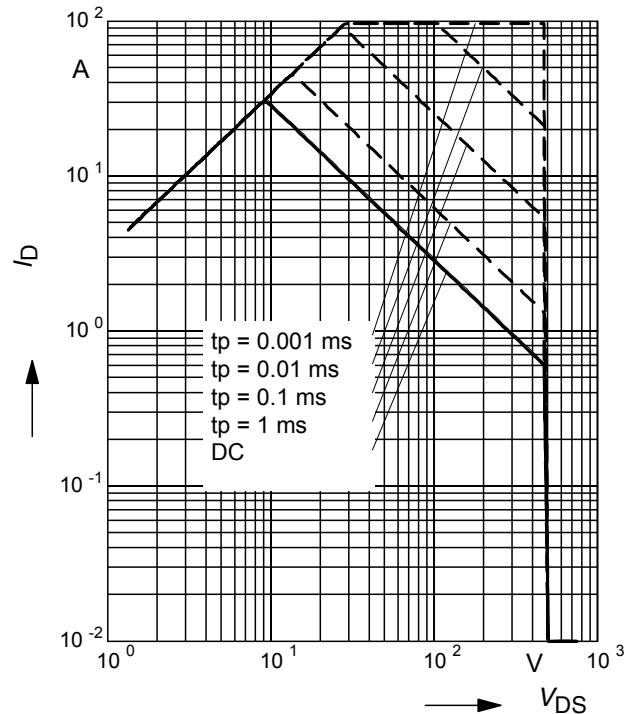
$$P_{\text{tot}} = f(T_C)$$



## 2 Safe operating area

$$I_D = f(V_{DS})$$

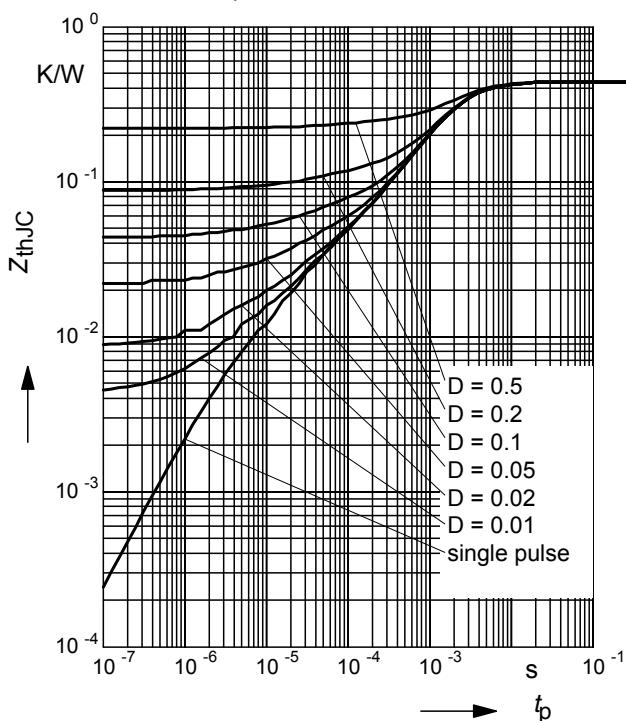
parameter :  $D = 0$  ,  $T_C = 25^\circ\text{C}$



## 3 Transient thermal impedance

$$Z_{\text{thJC}} = f(t_p)$$

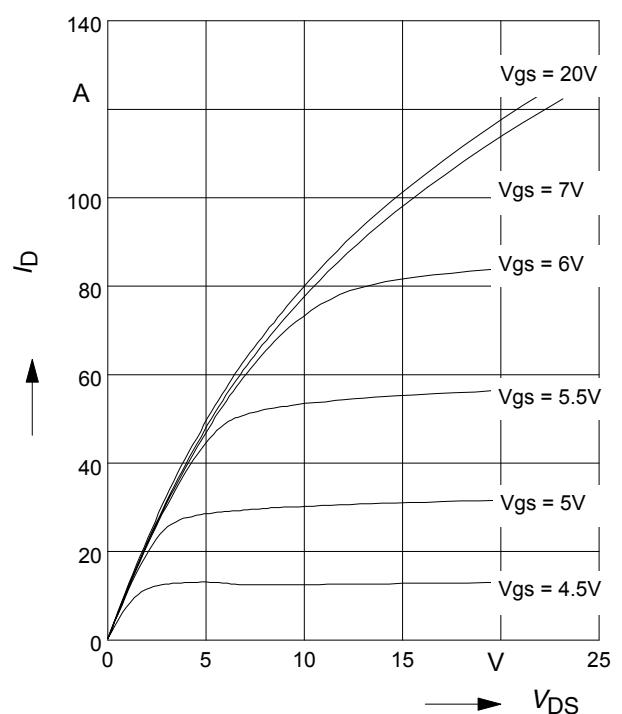
parameter:  $D = t_p/T$



## 4 Typ. output characteristic

$$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$$

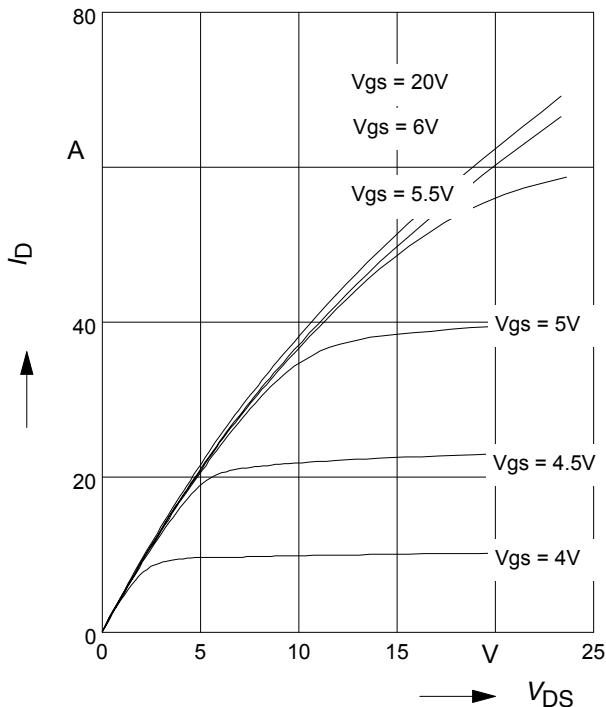
parameter:  $t_p = 10 \mu\text{s}$ ,  $V_{GS}$



### 5 Typ. output characteristic

$I_D = f(V_{DS})$ ;  $T_j = 150^\circ\text{C}$

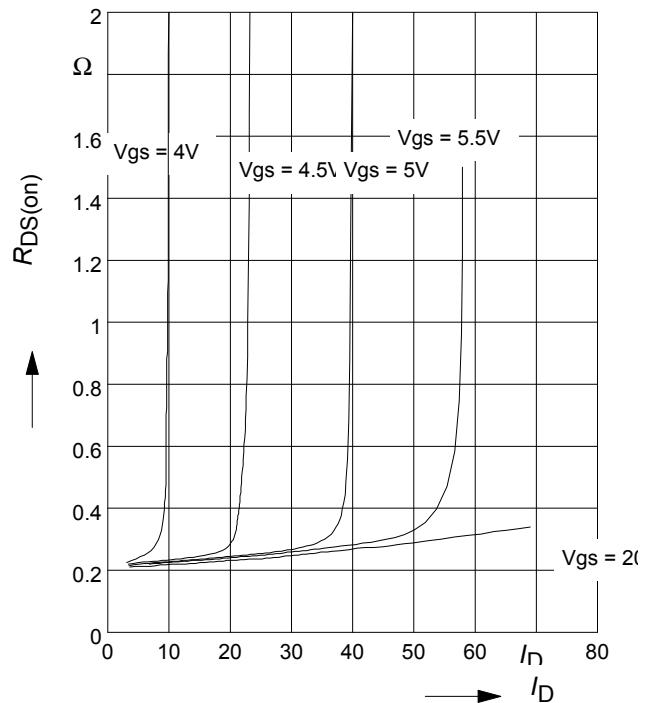
parameter:  $t_p = 10 \mu\text{s}$ ,  $V_{GS}$



### 6 Typ. drain-source on resistance

$R_{DS(on)} = f(I_D)$

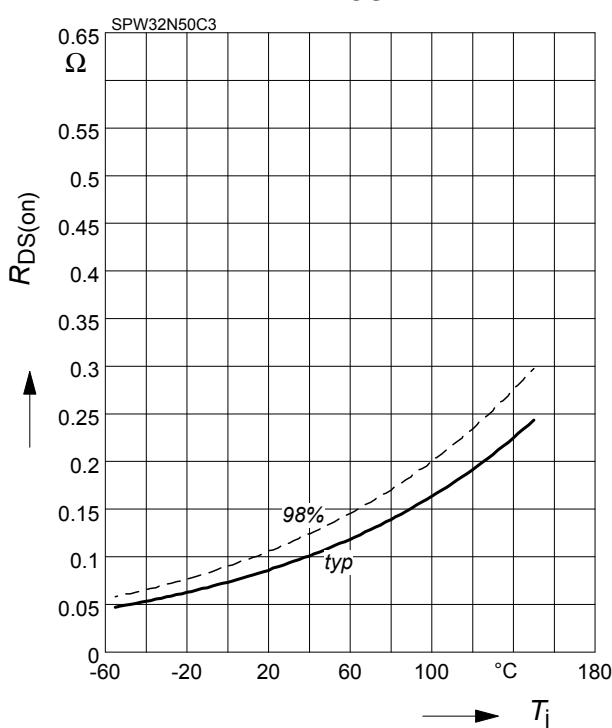
parameter:  $T_j = 150^\circ\text{C}$ ,  $V_{GS}$



### 7 Drain-source on-state resistance

$R_{DS(on)} = f(T_j)$

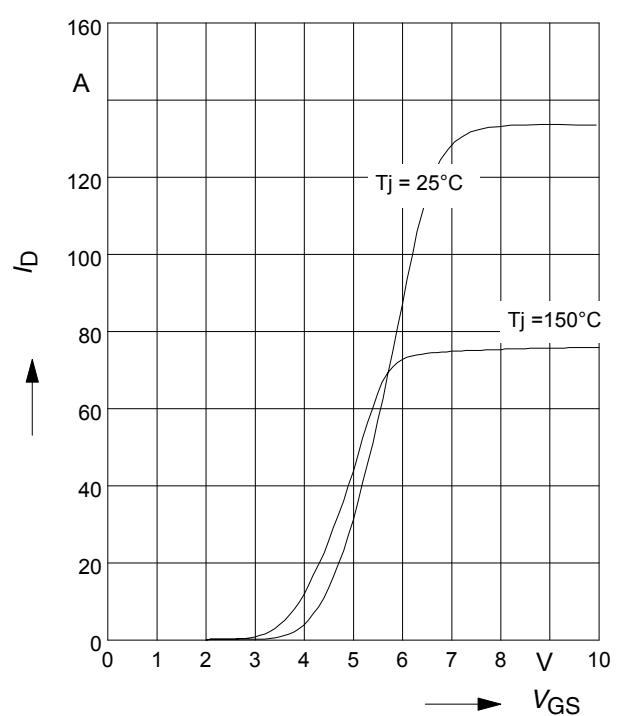
parameter :  $I_D = 20 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



### 8 Typ. transfer characteristics

$I_D = f(V_{GS})$ ;  $V_{DS} \geq 2 \times I_D \times R_{DS(on)\max}$

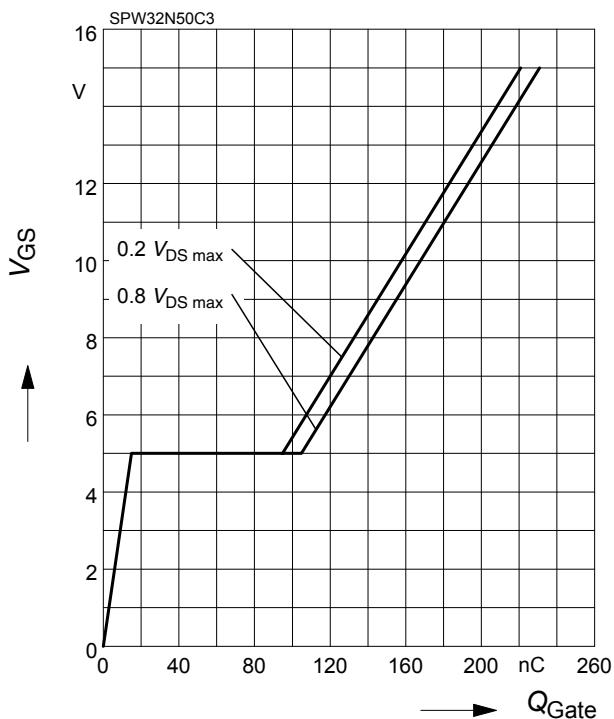
parameter:  $t_p = 10 \mu\text{s}$



### 9 Typ. gate charge

$$V_{GS} = f(Q_{Gate})$$

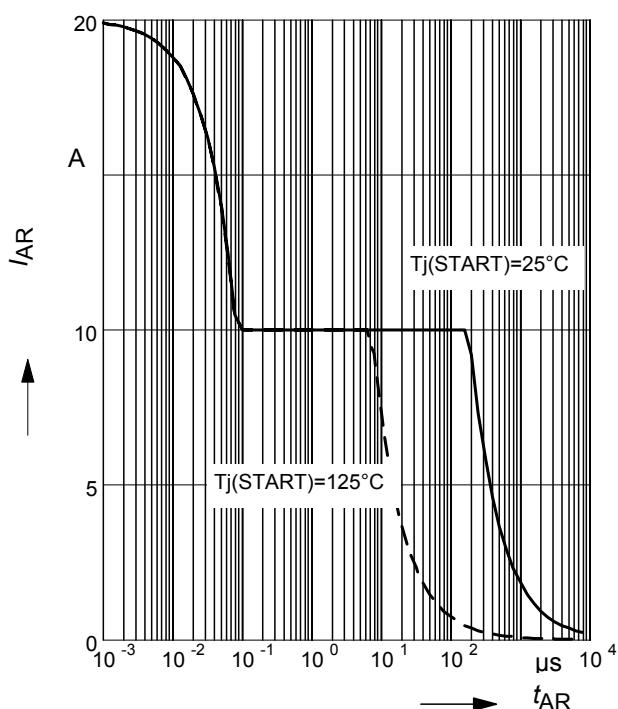
parameter:  $I_D = 32 \text{ A pulsed}$



### 11 Avalanche SOA

$$I_{AR} = f(t_{AR})$$

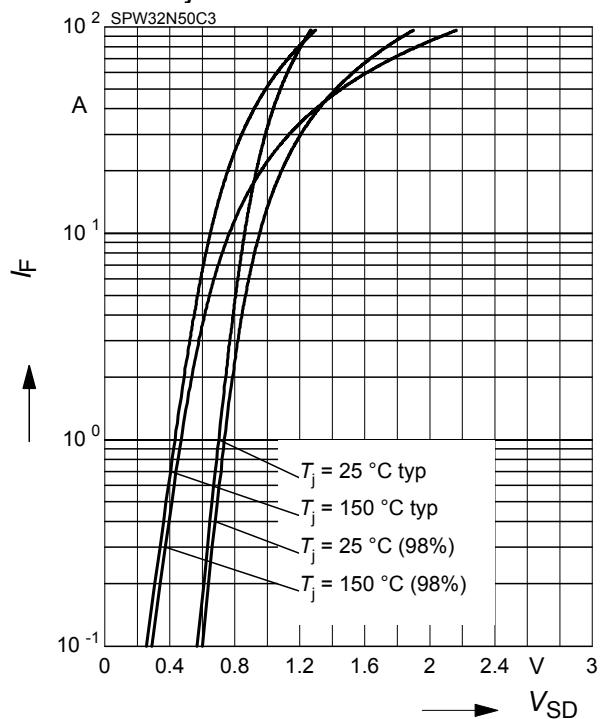
par.:  $T_j \leq 150 \text{ }^\circ\text{C}$



### 10 Forward characteristics of body diode

$$I_F = f(V_{SD})$$

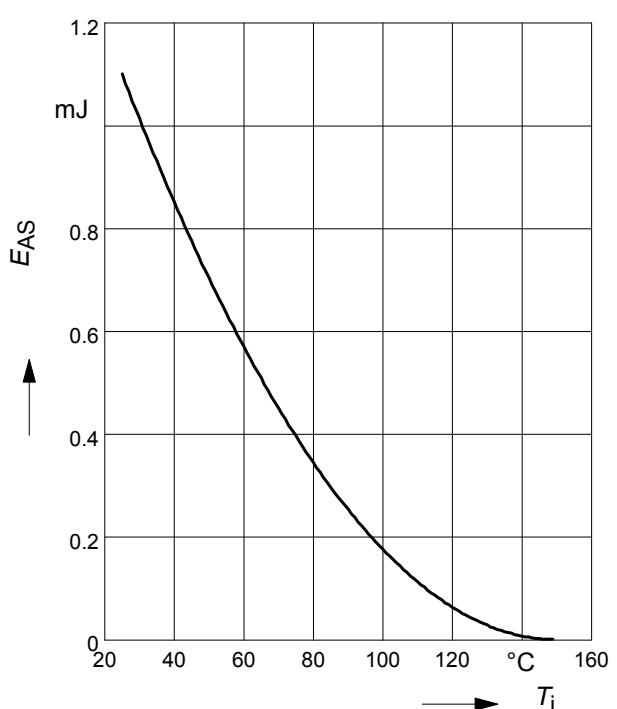
parameter:  $T_j, t_p = 10 \mu\text{s}$



### 12 Avalanche energy

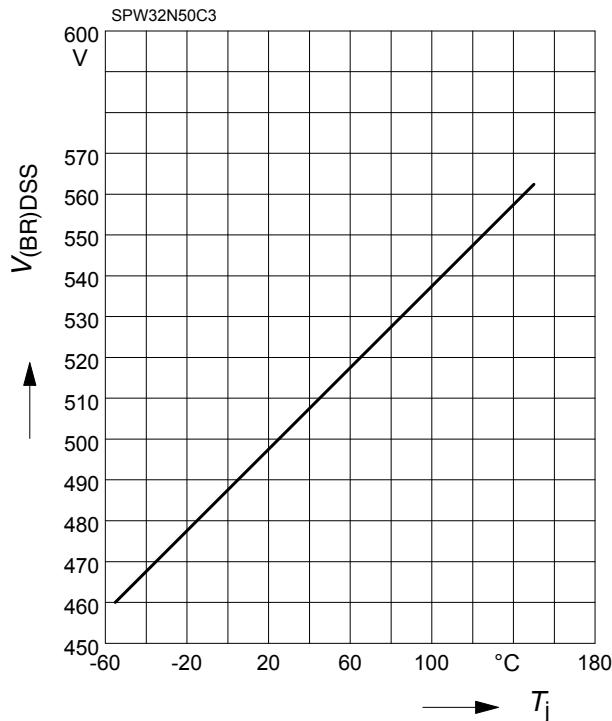
$$E_{AS} = f(T_j)$$

par.:  $I_D = 10 \text{ A}, V_{DD} = 50 \text{ V}$



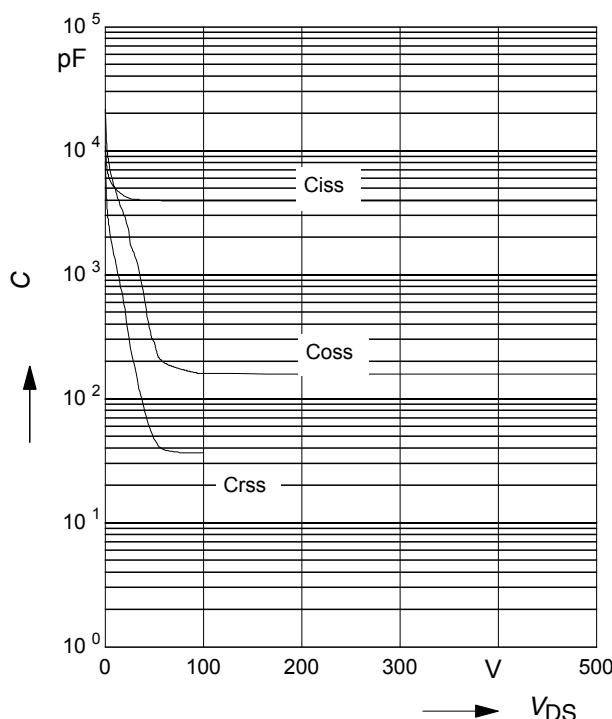
**13 Drain-source breakdown voltage**

$$V_{(BR)DSS} = f(T_j)$$


**15 Typ. capacitances**

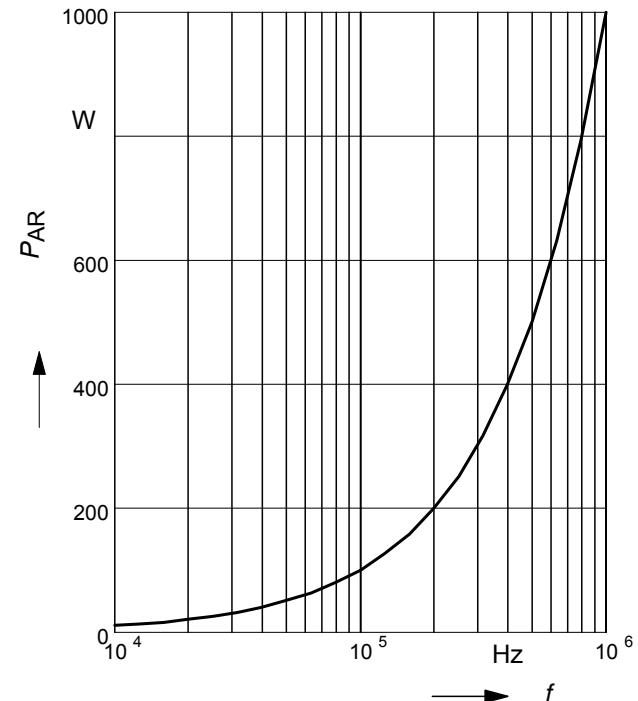
$$C = f(V_{DS})$$

parameter:  $V_{GS}=0V$ ,  $f=1$  MHz

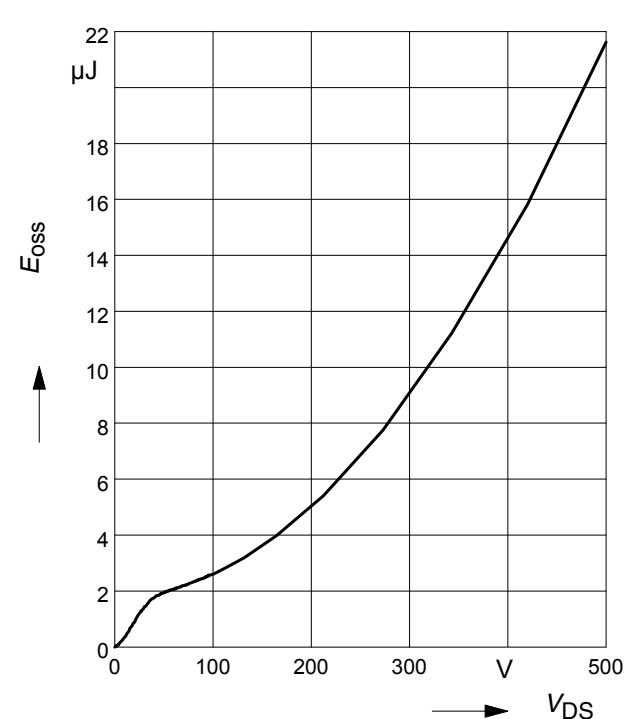

**14 Avalanche power losses**

$$P_{AR} = f(f)$$

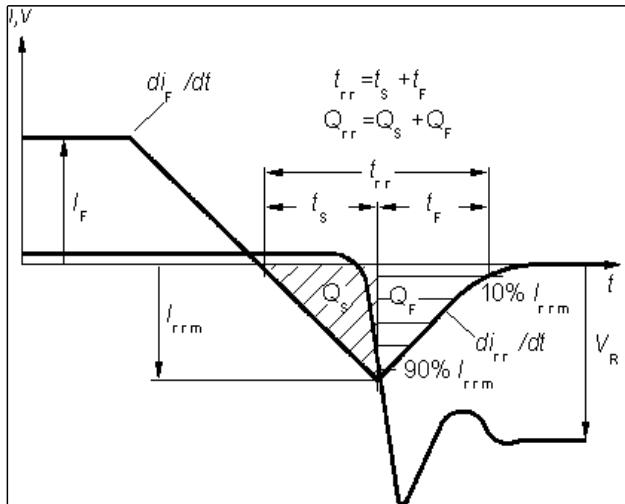
parameter:  $E_{AR}=1$  mJ

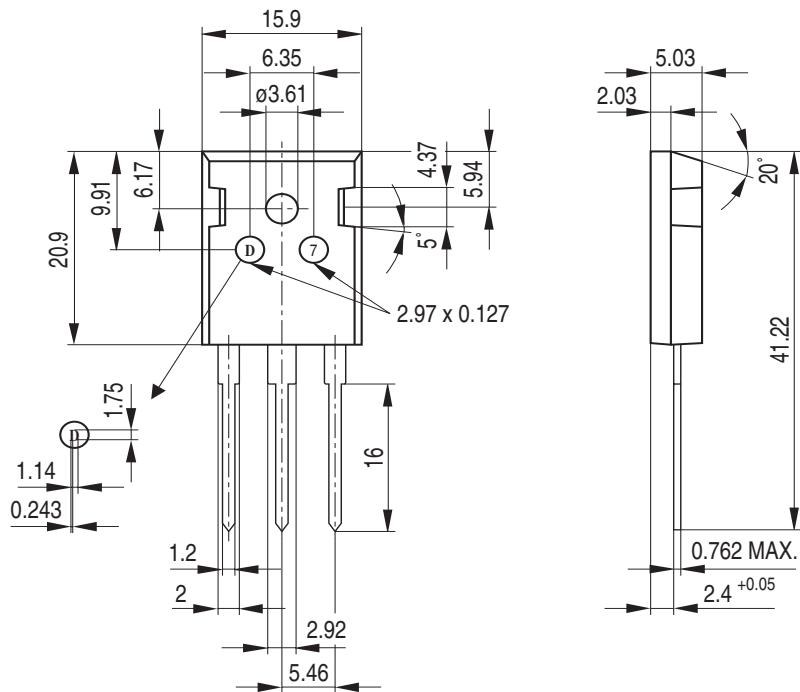

**16 Typ.  $C_{oss}$  stored energy**

$$E_{oss}=f(V_{DS})$$



### Definition of diodes switching characteristics



**P-TO-247-3-1**


General tolerance unless otherwise specified:  
 Leadframe parts:  $\pm 0.05$   
 Package parts:  $\pm 0.12$

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